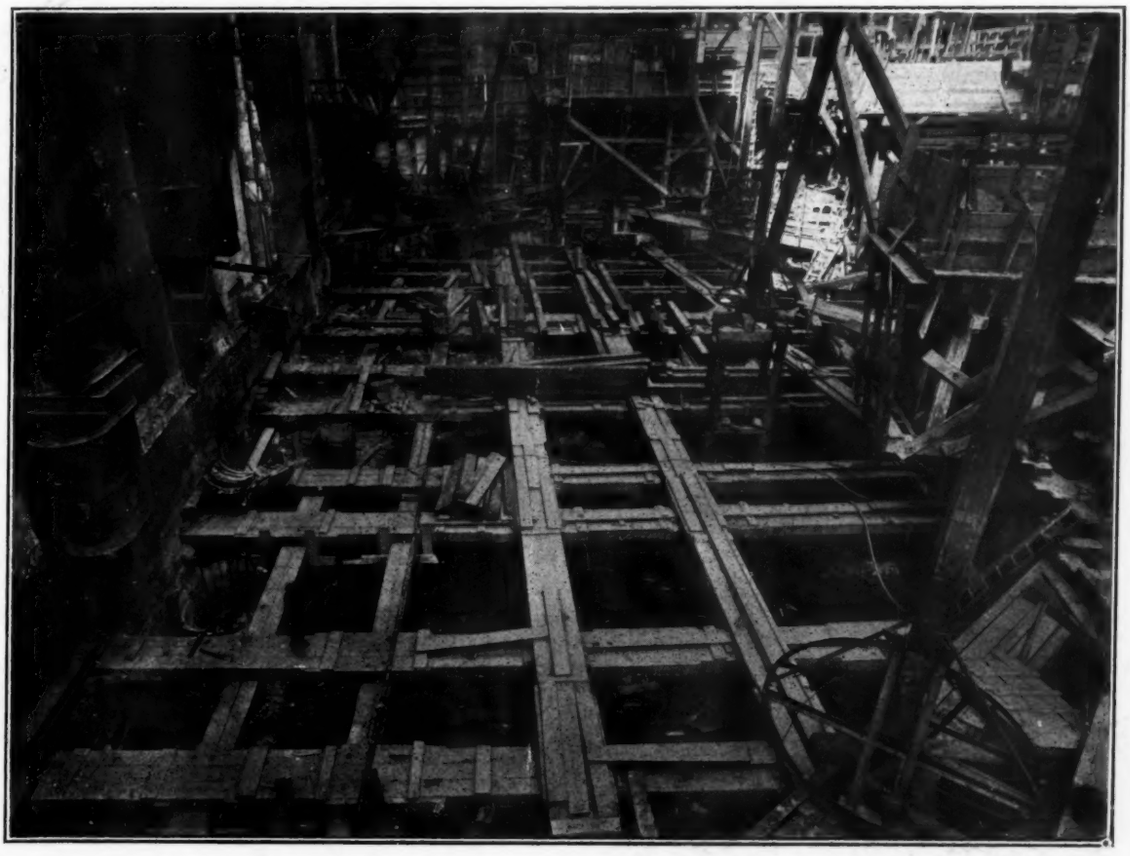
PUBLIC WORKS

CITY COUNTY STATE



NEW YORK STOCK EXCHANGE FOUNDATION. FIRST TIER OF TEMPORARY CROSS-LOT BRACING, PLACED SOON AFTER COMMENCING EXCAVATION INSIDE WALL CAISSONS

IN THIS ISSUE

JULY 30, 1921

EXPLOSIVES ~ SERVICE

NOTABLE IMPROVEMENTS

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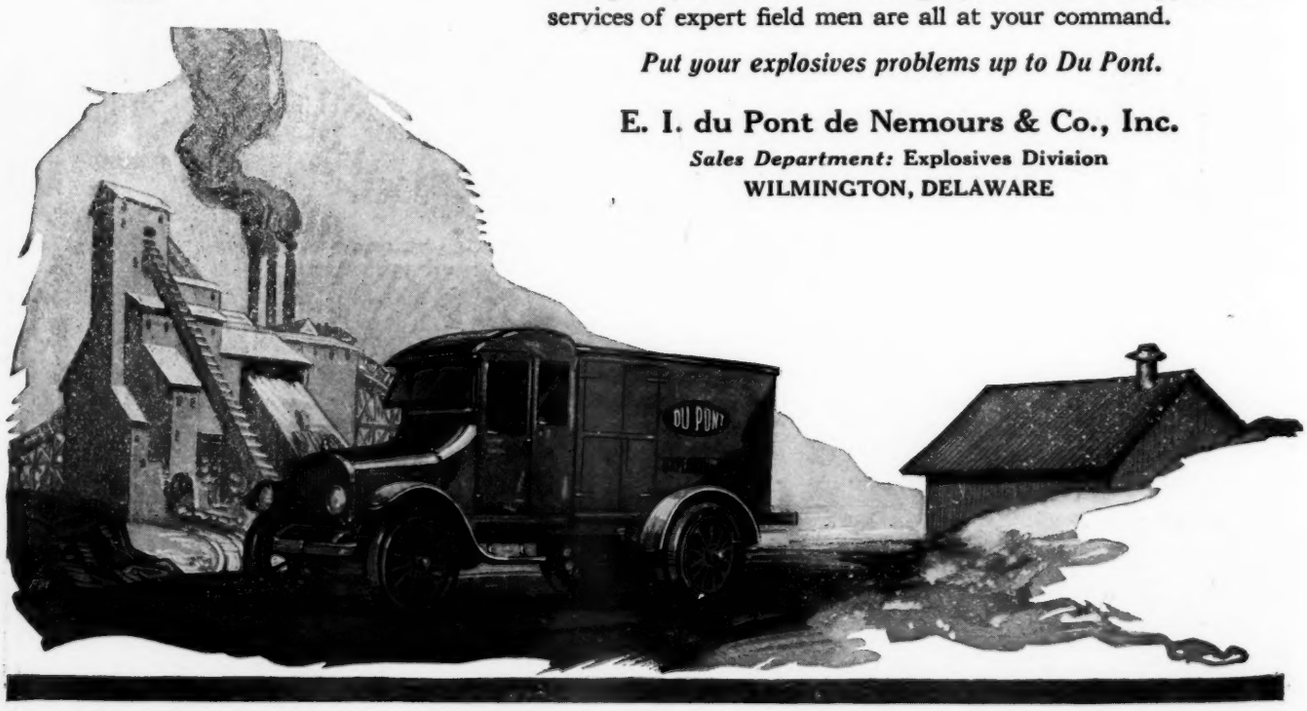

PUBLIC WORKS.

CITY **COUNTY** **STATE**

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Vol. 51 **JULY 30, 1921** **No. 5**

N. Y. Stock Exchange Foundations

Deep general excavation in quicksand and foundations for interior columns of tall steel building extension made inside permanent sectional concrete cofferdam 40 feet high, consisting of wall column piers sunk to bed rock by pneumatic caisson process and temporarily braced with 4 tiers of compound 12 x 12-inch cross lot braces.

The 21story steel frame addition being built to the Stock Exchange, New York, is trapezoidal in plan with fronts of about 141 feet on Wall street, 97 feet on New street, 60 feet on Broad street and 153 feet on the south side, adjacent to the old Stock Exchange building. It has three basements below curb level, the floor of the lowest being 63 feet below the curb. The substructure is built on solid rock at an average depth of about 65 feet below the curb and about 45 feet below ground water level. The soil consisted of about 55 feet of clay, sand and quicksand and 8 to 10 feet of hardpan overlying approximately horizontal sound rock, the surface of which pitched about 5 feet in the length of the building.

WALL CAISSONS CONCRETED AND STRIPPED READY FOR SINKING

CONTINUOUS WATERTIGHT FOUNDATION STRUCTURE

In order to carry the foundations to rock, to exclude water, and to provide the massive retaining walls to resist the unbalanced external pressure of water and quicksand, the concrete piers for the wall columns for three sides of the building were designed to form a continuous watertight structure, 7 feet thick, extending about 40 feet, from a little above ground water line to a little below the original surface of the rock on the three street sides of the lot, and joining the similar construction of the existing building on the fourth side of the lot.

This formed a complete watertight enclosure in which it was easy to excavate down to the surface of the rock in the open and avoid the trouble from quicksand, the danger of undermining the adjacent streets, and the expense of pumping. This has been successfully accomplished by the contractors, the Underpinning and Foundation Co., who built the piers for the foundation columns in pneumatic caissons sunk separately and subsequently connected by massive concrete joints that bonded them together and made a continuous watertight construction.

There are ten rectangular wall caissons 7 feet thick, 40 feet high and from 20 to 29 feet in length, and one special caisson 21 feet long with a width of 11 feet to enable its walls to clear two old cylindrical piers 6 feet in diameter near the center line of the location of this caisson.

CAISSONS AND DERRICKS SERVING THEM

After the building that formerly occupied the site had been removed, four stiff-leg derricks with wooden booms about 60 feet long were installed to command the site and portions of the adjacent street and to handle materials and plant in and out of the lot. Three of the derricks were equipped with Lidgerwood double-drum skeleton steam operated hoisting engines and were provided with Terry & Tench fittings. All of them were installed at approximately street level, three of them being supported on sets of three 20-inch I-beams 40 feet long spanning the corners of the lot and providing for working clearance underneath. The fourth derrick was supported on a falsework tower made with four 15-inch steel pipe piles 40 feet long, driven to hardpan without removing the core that entered freely through the open lower end.

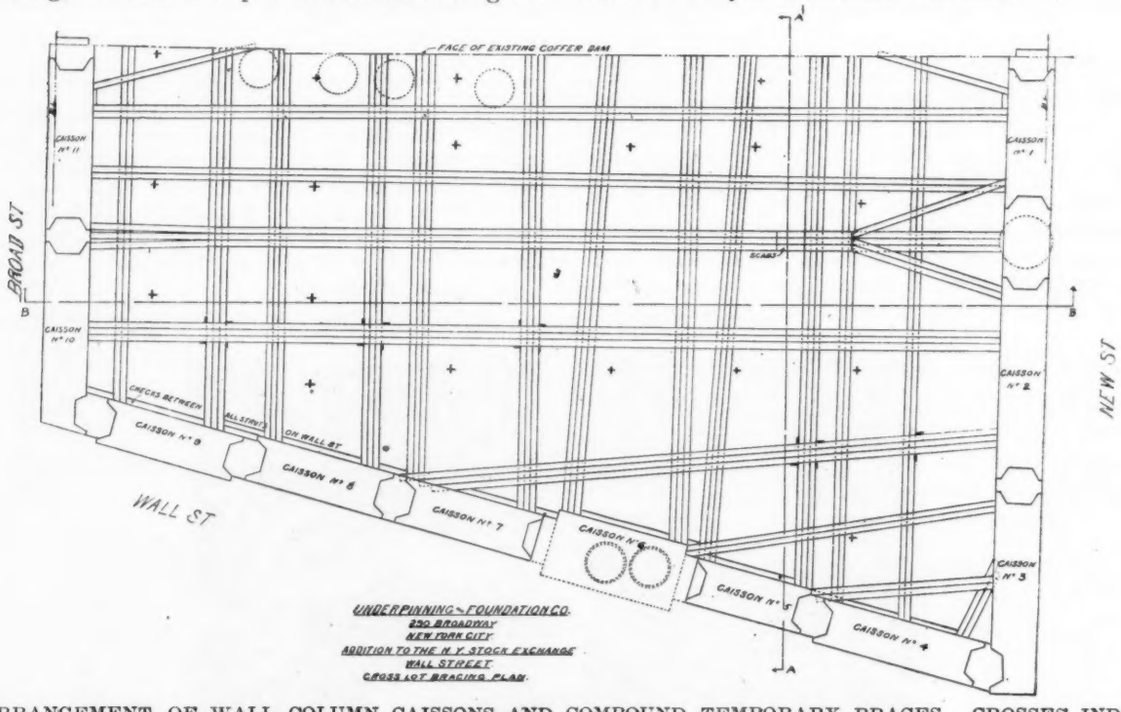
The wooden inner forms for the working chambers of the pneumatic caissons were built at the contractor's yards and delivered in halves by motor trucks. They were assembled in position at the bottom of the general excavation, which was carried down below the old cellar floor to a depth of about 20 feet below the curb, approximately to ground water level. The exterior forms of 3-inch vertical planks, spiked to external horizontal transverse screw end ¾-inch tie rods about 2 feet apart in tiers 4 feet apart vertically.

The walls of the working chamber, 3 feet 4 inches thick at the top, were offset on the inner faces to a thickness of about 10 inches at the bottom, where they were protected by 8 x 8 x ½-inch steel angles forming the cutting edge. They were reinforced by vertical, horizontal and inclined ¾-inch bars extending above the roof of the working chamber. Each caisson was provided with a central vertical air shaft 3 feet in diameter with two 3-inch low pressure and two 1½-inch high pressure air pipes and two 1½-inch air vent pipes.

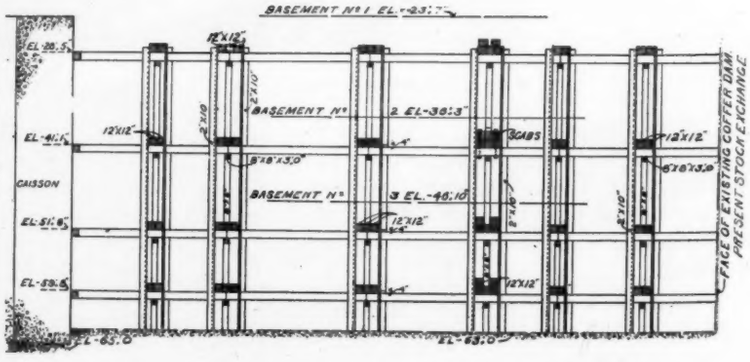
The end walls of the caissons were made the same as the side walls, but on their inner faces there was built a trapezoidal core in cross section, that formed, in the concreted pier, a semi-horizontal recess 18 inches wide reaching from the roof of the working chamber to the top of the caisson.

EXCAVATING AND CONCRETING

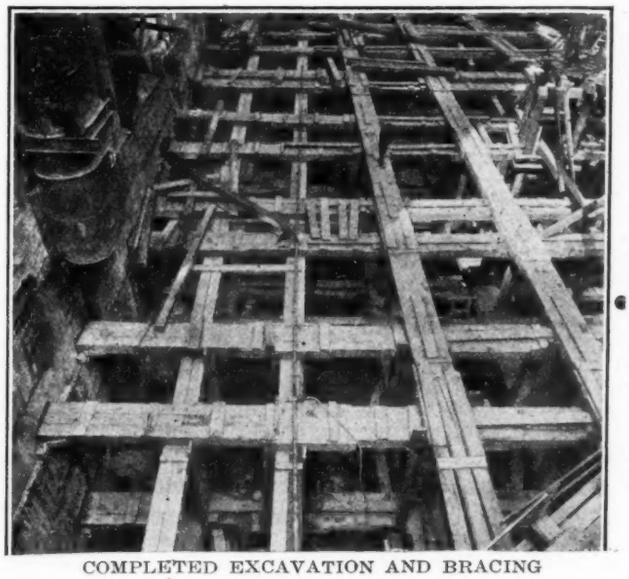
The caissons were well braced and concreted to their full height in three courses, requiring a total amount of about 3,200 cubic yards of concrete, mixed in a 1-yard Ransome machine.



ARRANGEMENT OF WALL COLUMN CAISSONS AND COMPOUND TEMPORARY BRACES. CROSSES INDICATE CENTERS OF COLUMNS



VERTICAL CROSS SECTION AA THROUGH BASEMENT STORIES SHOWING TEMPORARY CAISSON BRACING



COMPLETED EXCAVATION AND BRACING

As there was little room on the lot for carrying on the construction operations and none at all for storage of materials, the work was somewhat hampered by the necessity of delivering aggregate daily from the contractor's yards and from the dealers. The excavated material from the lot was shoveled by hand into buckets hoisted by the derricks and dumped directly into trucks on small working platforms at street level just outside the building line.

During the day the trucks were dumped at the foot of Wall street, less than half a mile away, but at night this dump was not available and the material excavated then had to be hauled several miles to a dump on Long Island. This requirement and the congestion of traffic and crowded streets caused considerable delay and expense.

As it was necessary to avoid any obstructions to either street or sidewalks adjacent to the building, the contractors provided heavy platforms on three sides of the building about 15 feet wide and 12 feet above the curb, which protected the sidewalk and were strong enough to carry a load of 300 pounds per square foot, thus enabling them to be used for storage, for small shops and for offices that commanded the work and caused no obstruction.

CAISSON SINKING

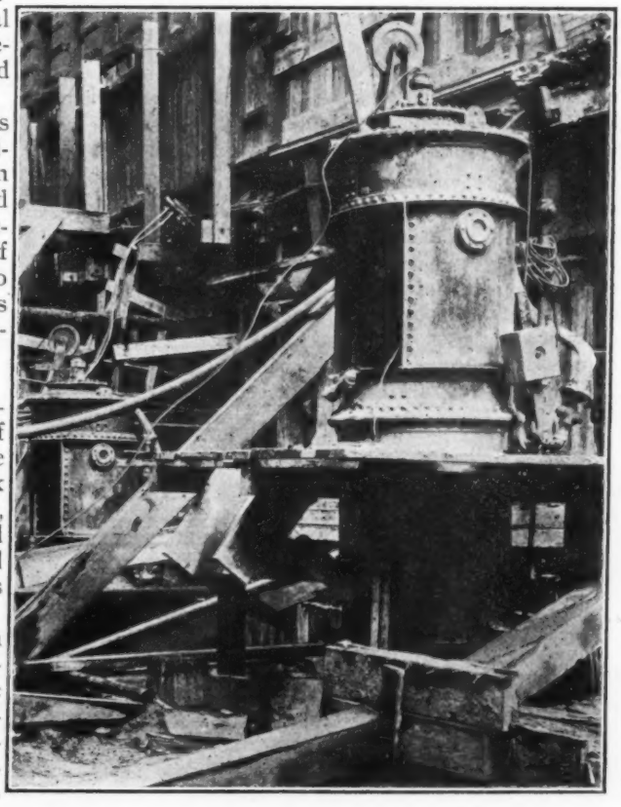
Alternate caissons were sunk in the usual manner by a crew of about 25 sand hogs in each of three 8-hour shifts daily, thus carrying on the work continuously until the caissons were sunk from 3 to 6 inches below the surface of the rock, which was leveled to receive them by drilling and blasting. The caissons were sunk and concreted under a maximum air pressure of about 25 pounds above atmospheric.

The forms for the working chamber of caisson No. 6, 11 feet wide, enclosed and cleared the upper end of the pair of old cylindrical concrete foundation piers that were removed as the caisson was sunk. Eight other similar piers encountered in the lot near the south wall of the building and elsewhere were removed as the open excavation was made around them. These piers, which had been sunk to rock about 20 years ago by John F. O'Rourke with the pneumatic caisson process, were in excellent condition and were still enclosed by the vertical wooden staves attached to inside horizontal angle rings originally placed there for the caisson forms or cofferdams. Holes were drilled through the staves and into the concrete, and the latter was blasted, the staves acting as a sort of protection to prevent the concrete from flying. After the concrete was broken up it and the staves were removed without difficulty.

On the New street side of the lot there existed a similar cylindrical concrete pier, 8 feet in diameter, which was preserved to form a portion of the permanent retaining wall there, as it was fortunately located on the center line of the new caissons that were subsequently bonded to it in the same manner in which they were connected to each other with vertical keys concreted into recesses cut in the surface of the old pier.

BONDING CAISSONS TOGETHER

The caissons were sunk with a clearance of 2 feet between their adjacent ends, and after their sinking had been completed wooden sheet piles were driven on the inner and outer faces of the caissons across the openings between them and the material between them was excavated to a depth of 5 feet and the exterior wooden forms that had been allowed to remain on the ends of the caisson when the side forms were removed before sinking were cut away together with the core boards previously mentioned in the ends of the caissons, leaving the recesses in the ends of the adjacent caissons opening into the space between the caissons.



AIR LOCKS ON CAISSONS BEING SUNK THROUGH QUICKSAND TO BED ROCK

A steel air shaft was set in the center of the space between the caissons and was concreted into a concrete slab filling all the space around it up to the surface of the ground. An air lock was installed on the top of the air shaft, air pressure applied, and the materials between the caissons excavated under pressure, the ends of the caisson forms being removed and the space between the caissons sheeted on each side as the excavation progressed to hardpan, where it terminated and the whole of the shaft thus produced was concreted under air pressure, the concrete extending into the recesses in both caissons and forming a bonded joint between the two.

Where the south ends of caissons No. 1 and No. 11 abut against the wall of the old Stock Exchange building vertical recesses 12 inches deep and 6 feet wide were cut in the face of the old building caisson opposite the end of the new caisson, air locks installed, and the material underneath excavated, and the cuts in the old caissons were extended downward to hardpan and subsequently concreted to form joints there similar to those between the new caissons.

A similar joint was made between the old 8-foot cylindrical pier and the adjacent new caissons Nos. 1 and 2, thus completing the continuity of the watertight construction around all four sides of the lot.

OPEN EXCAVATION OF DRAINED QUICKSAND

After the completion of the wall caisson, the entire area of the lot enclosed between them was excavated down to hardpan without difficulty from water or quicksand. As no water entered through, between, or under the caissons, the small amount contained originally in the soil was easily removed by a 6-inch centrifugal pump with its suction in a sump maintained a few feet below the bottom of the progressive excavation, and thus drying the soil so that it lost its quicksand character and was easily handled by pick and shovel.

TEMPORARY WALL BRACING

As the excavation progressed the exterior pressure on the caissons was resisted by horizontal cross-lot bracing consisting of sets of longitudinal, transverse, and diagonal 12 x 12-inch timbers in four successive tiers supported at intersections on vertical posts, and arranged to clear the steel framework subsequently erected.

The first tier, about 25 feet below the curb, engages the inner faces of the caissons near their upper ends and was put in place as soon as the excavation had been made a few feet below it so as to allow headroom for working clearance under the braces.

After the excavation had been carried about 13 feet farther, a second tier was installed and subsequently the third and the fourth tiers 8 feet and 10 feet lower, respectively, the lower tier being about 6 feet above the cutting edges of the caissons.

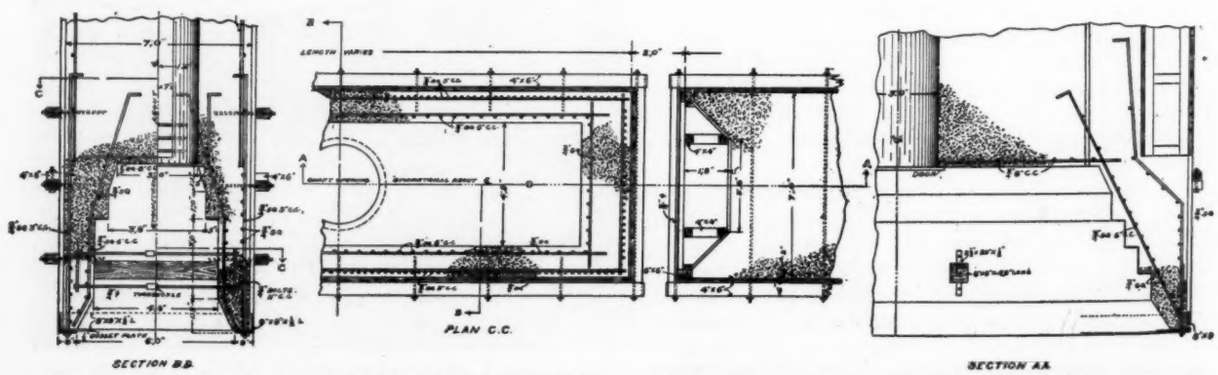
The braces were made in sections of convenient length with staggered butt joints without framing, cutting, or much bolting, and the braces were adjusted by pairs of folding steel wedges 2 inches wide, driven between pairs of steel bearing plates separating the ends of timbers and the faces of the caissons.

It was assumed that the caissons would be subjected to an unbalanced pressure equal to the full theoretical hydrostatic pressure on the exterior face of the caissons, and the timbers were proportioned for a working strain of 5,000 pounds per square inch. They contained in all about 300,000 feet B. M. of timber, which was uninjured and will have a high salvage value after it is removed when the steel framework has been put in place and the lower floors built and brought to bearing against the caissons so as to serve as permanent bracing for them, releasing the timber in the temporary timber construction.

Sidewalk vaults about 12 feet wide will be built above the tops of the caissons, and the earth in the street will be retained there during construction by about 8,000 square feet of 3-inch tongue and groove sheet piles, 25 feet long, driven by a No. 3 McKiernan-Terry steam hammer. The piles will be driven against the existing brick walls, which will then be removed and new permanent walls built in their place. This, however, will not be done until the steel framework for the building has been erected to the second floor above street level so as to afford reaction for bracing the old walls.

The principal mechanical equipment installed on the job by the contractors included Ingersoll-Rand BCR jackhammer drills, and Denver Rock Drill Company's Waugh hammer drills, 6 Matson air locks, about 250 tons of 2-ton cast iron ballast blocks for sinking the caissons and the usual equipment of miscellaneous plant and small tools.

The work has been executed by Marc Eidlitz



DETAILS OF TYPICAL CAISSON, SHOWING FORM FOR LOWER PART AND ARRANGEMENT OF WORKING CHAMBER, SHAFT AND RECESS FOR BONDING WITH ADJACENT CAISSON

& Son, Inc., general contractors, with a maximum force of 75 to 100 men under the direction of W. P. McKibben, general superintendent, and S. G. Brett and H. Williams, engineers. Trowbridge & Livingston are the architects of the building and Daniel P. Moran is consulting engineer.

San Francisco Bay Bridge

The agitation for a bridge across San Francisco bay has finally reached the definite point of a preliminary report by two engineers of national reputation, John V. Davies and Ralph Modjeski. These engineers were employed by a bridge committee appointed by San Francisco, Alameda and San Mateo counties and others, to report upon the feasibility and best general plan of connecting San Francisco with the cities across the bay by tunnel or bridge for carrying both railway and the vehicular traffic.

After a preliminary investigation of several days, these engineers recommended a combination structure consisting of about 3,500 feet of subaqueous tunnel crossing the channel and rising by a long incline to a bridge about 12,000 feet long over shallow water, which bridge is succeeded by 3,000 feet of pile trestle and this in turn by about 12,000 feet of fill.

The engineers call attention to the fact that this project, if carried out, will be a unique structure. The entire crossing might possibly be made in tunnel but it is extremely questionable whether it would be practicable to ventilate a tunnel the length of this, through which automobiles will be passing and contributing gasoline fumes. A preliminary estimate of cost is given as $40,000,000, which is believed to be ample to cover preliminary surveys, engineering, construction, interest on money during the construction period and all other items. The engineers suggest that charges be made of 5 cents per passenger and 75 cents per vehicle, which, with tolls from railroad, freight, electric ducts, etc., should bring in over $1,500,000 the first year, increasing to $3,630,000 the fifth year and continuing to increase thereafter. Their estimate would indicate that the interest charges on the utility would not be earned until the fourth year of operation, but thereafter the returns should be fairly satisfactory and initial deficits made good. This calculation is made with the assumption that the project will be constructed as a private enterprise, but the engineers are of the opinion that it should without question be ultimately acquired, owned and controlled as a municipal one.

The Waste of Water in Detroit*

Result of a study of consumption, including Pitometer survey and meterage record of a city that is 98 per cent metered, extending over several years. Domestic, commercial, and municipal consumption by day and night.

For a number of years the water department of Detroit has been making a special study of the matter of water waste. At first this was confined largely to house to house inspection, but beginning with 1914 metering was extended to include practically all consumers. In May, 1919, when nearly 100 per cent of the services had been metered and the consumption was still found to be high, the Pitometer Company was employed to conduct a water waste survey of the distribution system of the city. This survey is still being continued, five of the seven sections into which the city is divided having been completely surveyed by May of this year, and about 50 per cent of the sixth section.

There are several reasons why information concerning consumption and waste of water in Detroit should be of unusual interest. The system was installed nearly 100 years ago and pipes laid eighty years ago are still in service; 98 per cent of all active service connections are now metered; the system is a direct-pressure one and hourly records of consumption are therefore available; it is the largest city in the United States that has nearly all of its connections metered; and the entire supply used for domestic purposes is obtained from the public system, the water available from wells being negligible.

The distribution system contains 1,480 miles of cast iron pipe from 4 to 48 inches diameter and 3 miles of 48-inch steel pipe.

A reservoir was used until 1887, when it was discontinued and since then the system has been operated as a direct-pressure one. Since 1913 all water pumped has been metered at the pumping station; in calculations made before 1913 allowance was made for pump slip.

In 1882 the per capita consumption was given as 120 gallons a day and as 209 gallons in 1887. By 1891 this had fallen to about 150 gallons. The marked decrease from the high consumption rate in 1887 was due to at least three causes—the use of meters (although the number set was small), careful inspection of premises, and the elimination of waste at the pumps. In explanation of the last it may be said that the pumps were two of 24,000,000 gallons capacity each and that during a considerable part of the time the capacity of the pumps when working at minimum speed was greater than that needed to supply the city, and large quantities of water were allowed to flow back into the suction well. The introduction of by-passes permitted the capacity of the pumps to be changed at will to 12,000,000 gallons per day.

*Abstract of a paper before the American Water Works Association by George H. Fenkell, General Manager of Water Department.t

WASTE SURVEY

Much of the information was obtained from the Pitometer survey. The total number of service leaks found by this survey in 80 per cent of the area of the city surveyed up to May 1, 1920, was 447, wasting approximately 10,000 gallons per day for each service; 116 were found to be wasting about 23,300 gallons each.

The survey had located, uncovered and stopped leaks in mains amounting to 2,533,000 gallons per day. Altogether the survey had stopped underground leaks from all causes amounting to about 7,000,000 gallons a day. About one-half of all the mains in the city and 80 per cent of the population are included in the area surveyed and it seems probable, therefore, that when the survey has been completed 10,000,000 gallons of underground leaks per day will have been stopped.

The purpose of the survey was not only to locate and stop underground leaks in mains and services, but also to check up all industrial consumers and discover unauthorized use of unmetered water. It included a field test of all meters larger than three inches in diameter. Each of the seven sections of the city was divided into as many districts for individual study as was made convenient by the location and size of the larger mains of the distribution system; 120 districts have been measured to date and permanent gaging points established in each district for the future control of waste. The total minimum night rate in the districts measured amounts to 86 gallons per capita per day.

In spite of the fact that 98 per cent of the services were metered, in many instances the rates of flow were so high as to indicate heavy leakage and yet no leaks of mains or services were found to exist. Here house to house inspections were made and these high rates were found to be caused by leaking plumbing fixtures.

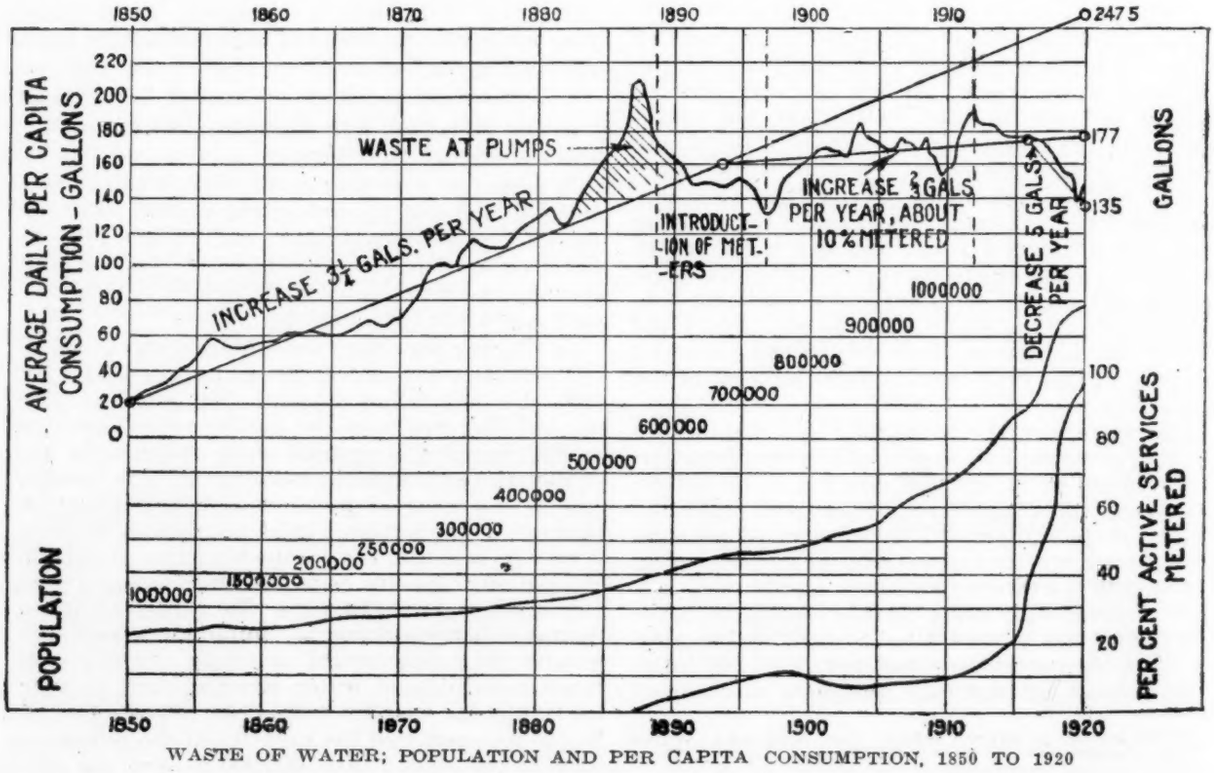
Meters larger than three inches to the number of 356 have been tested and in many cases under-registration has been found and repaired. So far no unauthorized use of water has been discovered, which may be accounted for in part by the metering of many fire lines and the careful inspection of the remaining fire lines.

The survey revealed four broken mains leaking 562,000 gallons a day, twelve joint leaks of 861,000 gallons per day, three open blow-offs flowing 800,000 gallons, two blown plugs 190,000 gallons, three valves with bad stuffing-box leaks 85,000 gallons, and two defective fire hydrants leaking 35,000 gallons; a total of 2,533,000 gallons per day. Leaks were found in 116 service pipes caused by broken pipes, abandoned services and blown corporation cocks, the total leakage from which was 2,704,000 gallons per day. This gives a total leakage of 6,892,000 gallons.

ANALYSIS OF CONSUMPTION

A large part of Mr. Fenkell's paper is devoted to figures and calculations based upon meter measurements, pump records and other data and assumptions. In using meter records an allowance of 5 per cent was made for under-registration of meters.

The number of metered domestic accounts was arrived at by subtracting from the accounts where meters were 1½ inches or smaller the number of commercial accounts as determined by careful examination of the city directory. The amount furnished 2,985 domestic flat-rate accounts is estimated by allowing 1,000 gallons for every five cents of flat-rate revenue.



WASTE OF WATER; POPULATION AND PER CAPITA CONSUMPTION, 1850 TO 1920

It was estimated that the total amount of water furnished for municipal purposes was 17.44 gallons per capita per day, or 13 per cent of the total quantity of water consumed within the city limits. This includes 0.39 gallons furnished free to charitable institutions and 0.95 at one-half rate to other charitable institutions. Flooding trenches is charged with 7 cubic feet per lineal foot for 200 miles of trench. The estimates for paving, sprinkling and flushing streets, and for flushing sewers are based on data furnished by the department of public works. Other public consumption is that in the 42 engine houses, 15 ladder houses, 11 police buildings, 5 parks, libraries, public schools, etc. The Pitometer Company found the average daily consumption of unmetered park fountains to be 45,000 gallons. The continuous flow sanitary drinking fountains were estimated to use 1,100 gallons per day each. Eight skating ponds were estimated to use 80,000 cubic feet a season each. A careful estimate gave 30,644,000 gallons of water as the amount used in extinguishing fires. From these and various measurements and assumptions the table of consumption given herewith was prepared. It is known that considerable amounts are used that are not included in the table, such as for extinguishing fires in coal piles, street sprinkling wagons in the business district and street sprinkling of car tracks by the street railway.

The Consumption of Water in Detroit

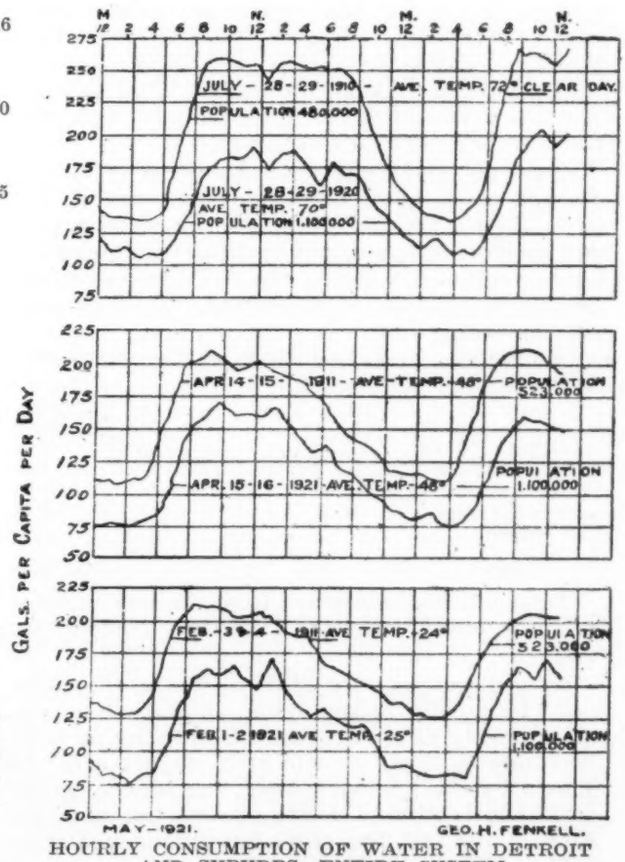
		Gallons Per Capita Per Day
DOMESTIC		
131,692	Metered accounts	46.48
2,985	Flat-rate accounts	4.23
	Service connection leaks	5.45
		56.16
COMMERCIAL		
1,219	Industrial plants and railroads	42.77
7,416	Accounts—stores, etc.	6.42
	Building construction	0.21
		49.40
VILLAGES AND OUTSIDE TERRITORY		
25	Accounts—villages	9.62
14	Accounts—factories	3.53
		13.15
MUNICIPAL		
	Flooding trenches	0.16
	Paving	0.27
	Sprinkling and flushing streets	0.53
	Flushing sewers	0.02
42	Engine houses	0.05
15	Ladder houses	0.03
11	Police buildings	0.11
38	Parks and boulevards	7.23
12	Park fountains	0.56
300	Drinking fountains	2.87
8	Skating ponds	0.01
14	Public libraries	0.01
161	Public schools	3.01
75	Private schools	0.55
35	Public buildings	0.67
62	Charitable institutions	
	32 Free	0.39
	30 Half rate	0.95
	Fires	0.12
		17.44
WATER WORKS		
	Leaks in mains	3.26
	Flushing mains	0.72
		3.98
		140.14
	Unaccounted for	4.36
	Average per capita consumption per day determined by Venturi meter measurement July 1, 1920, to April 30, 1921	144.50

Estimate of the Daily Per Capita Consumption of Water Used at Night Rate for Public Purposes

MUNICIPAL

	Gallons Per Day Per Capita	Gallons Per Day Per Capita at Night Rate
Flooding trenches	0.16	0.00
Paving	0.27	0.00
Sprinkling and flushing streets	0.53	0.53
Flushing sewers	0.02	0.00
Engine houses	0.05	0.025
Ladder houses	0.03	0.015
Police buildings	0.11	0.11
Parks and boulevards	7.22	4.00
Park fountains	0.56	0.56
Drinking fountains	2.87	2.87
Public libraries	0.01	0.00
Public schools	3.01	1.00
Private schools	0.54	0.18
Public buildings	0.67	0.50
Charitable institutions	1.33	1.00
Fires	0.12	0.12
Skating ponds	0.01	0.01
	17.41	10.92

In only 50 cases was water found running to prevent freezing. This survey, however, was continued throughout the year and covered only part of the city, because of which and of the mildness of the winter it was thought the amount ordinarily wasted to prevent freezing would considerably exceed this. The average waste from one tap to prevent freezing is 2,000 gallons a day. With one tap in one hundred allowed to flow for three months, the average daily waste for the year would be 0.75 gallons per capita, and this is the amount estimated.



HOURLY CONSUMPTION OF WATER IN DETROIT AND SUBURBS—ENTIRE SYSTEM

The summer of 1920 was cool and comparatively little water was used for sprinkling, and the survey, therefore, gave little information on this point. If it is assumed that two-thirds of the services are used for sprinkling one-half hour every second day during a period of three months, the yearly consumption will be 1.8 gallons per capita.

From night measurements made of several residence streets and averages prepared it was estimated that the leakage through defective plumbing fixtures could be taken at 22 gallons per capita. Combining these several figures for night flow Mr. Fenkell obtains the following as the total night consumption accounted for.

Night Consumption Accounted For

	Gallons Per Capita
Manufacturing night consumption, metered, covering district including 80 per cent of the population	19.82
Underground leakage, measured, covering same district	8.91
Underground leakage, not measured, 650 miles of mains at 3,000 gallons per mile	2.44
Public night use, estimated	10.92
Night domestic use, estimated	22.00
Total consumption accounted for	64.09

The minimum night rate actually furnished 80 per cent of the districts surveyed was 86.42 gallons, and the difference between this and the 64.09 gallons gives 22.33 gallons as the leakage per day through defective plumbing fixtures.

From an examination of the records of the waste water survey, 4,336 leaking fixtures were located and the waste from 90 per cent of these was measured and that from the balance estimated. The waste averaged 977 gallons per leaky fixture. Assuming that this was 10 per cent below the actual leakage, this gives 23.64 gallons per capita which checks quite closely with the 22.33 gallons calculated as above.

It was known that considerable water is wasted through carelessness but there is no way of determining the amount. It was assumed, however, that each of the connections was allowed to waste for five minutes a day at the daily rate of 3,000 gallons, and this gave an average of 1.5 gallons per capita per day.

Combining these, we have as the estimated daily consumption:

	Gallons Per Capita
To prevent freezing	0.75
Lawn sprinkling	0.90
Leaks in service connections	5.45
Leaks in fixtures	22.33
Carelessness	1.50
Total	30.93

This quantity subtracted from the total domestic consumption leaves 25.23 gallons for domestic use.

In a direct-pressure system, where the plant must be capable of supplying water at the maximum hourly rate, the effect of metering on such maximum hourly rate is of great importance. As shown by the following table, the ratio of maximum hourly rate to average hourly pumpage for each of the last ten years has diminished from 1.73 to 1.55.

1910	1.73	1915	1.52
1911	1.75	1916	1.51
1912	1.59	1917	1.55
1913	1.75	1918	1.50
1914	1.64	1919	1.68
		1920	1.55

One rather unusual statement made by Mr. Fenkell is that "consumers have looked on metering with favor and there has been no opposition to the movement from any class." The rule in Detroit has been for domestic consumers to prepare their plumbing for the meter and for the board to set and maintain the meters without charge or rental.

Cement Production in 1921

From information obtained by the United States Geological Survey covering the first six months of 1921, it appears that the amount produced was about 94 per cent as great as in the corresponding period of 1920, and that the production and shipments have both increased considerably since the first of the year. In January, the production was a little over 4,000,000 barrels, and the shipments a little over 2,500,000. Both production and shipments have increased steadily until in June the production was 9,296,000 barrels, while the shipments totaled 10,577,000. This production was slightly greater than that of June, 1920, and the shipments for June were greater than those for any preceding June.

"These figures indicate that the cement industry has enjoyed relatively greater activity than many of the other large mineral industries during the first half of 1921, and that stocks of finished cement and clinker, while not excessive, are ample to supply any reasonable demand."

Winter Bridge Erection in Alaska

The 504-foot channel span of the United States Government Railway bridge across the Susitna river of Alaska has two pin-connected steel trusses, the erection of which on trestle falsework was completed in midwinter when the temperature was at times as low as 42 degrees below zero.

The members were assembled by a 100-ton locomotive crane with a 50-foot boom in the yard. There were required in the 1,800 tons of steel about 42,000 rivets, some of which were driven on days when the temperature from — 12 to — 42 degrees and were afterwards several times tested and demonstrated to be first class. The span was swung and put into service early in February, 1921. The work was under the general supervision of Col. F. Mears, chairman and chief engineer of the Alaskan Engineering Comission. The steel work was fabricated and erected by the American Bridge Company. The designs and details were checked and approved by Modjeski & Angier, consulting engineers.

Trackless Trolley for Akron

Akron, Ohio, is to have a trackless trolley car operated by the local traction company as an experiment. The city may finance trackless trolley car extensions by loaning money to the traction company should the trial car prove a success.

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CONTENTS

Commendable Attention to Legislation

A serious and almost universal fault, and one that carries its own penalties, is the unfortunate tendency of individual engineers, contractors, officials and their organizations and societies to content themselves with purely technical activities and neglect the attention they should bestow on commercial, financial and public matters and especially on political activity that may prove a serious menace or that die from lack of proper encouragement when they might be made effective for great public good.

The advantage of a systematized recognition of the importance of attention to legislation that is proposed or in progress, is shown by the record described in this issue of good results promoted by the timely and influential action of the Committee on Law and Legislation appointed by the New York General Contractors' Association, a small but powerful organization, affiliated with the Associated General Contractors of America. This association has long taken an active and intelligent part in the New York legislation affecting construction matters and during the term of the legislature which adjourned on April 16 had under consideration 46 of the total number of 3,960 bills, about 900 of which were passed.

The committee took action on 27 of the 46 bills selected, and of these the final legislation on 25 was satisfactory. This shows very efficient results for 2 per cent of the entire legislation, and a very high degree of efficiency for the work undertaken. The legislation secured improvements in the requirements for retained percentages, in the restriction on water works labor, and in contract payments. The important bills defeated included those having to do with civil engineers' licenses, with transportation costs, paving rates, the employment of double labor on pneumatic hammers, strikes, indemnity and compensation features that might occasion serious damage and inconvenience to construction interests.

It is always difficult and generally impossible for an individual, no matter how well qualified, or even how much leisure and abundant facts may be at his disposal, to successfully promote or combat legislation, but it is entirely within the ability and certainly within the province of organizations for legitimate professional or business interests to give authoritative assistance to their qualified expert representatives. This is one of the aims of the Associated General Contractors of America and should be appreciated and emulated by its affiliated societies and by the other societies and individuals throughout the country who will always find their efforts welcomed by the larger society.

Pneumatic Caisson Foundation in New York

Pneumatic caissons, which have long been used for difficult foundations for bridge piers, abutments, lighthouses, retaining walls, tunnels, shafts, etc., have generally been used only for one kind or another of public work, except in New York City, where for the last 25 years they have frequently been used to carry the heavy column loads of tall office buildings below ground water level to hard stratum.

Their design and method of construction has been highly specialized and perfected. They have proved very efficient and satisfactory under the unusually difficult conditions in New York City, where deep cellar excavations have to be made and foundations sunk through 50 or 100 feet of quicksand to rock bearing.

One of the features of this class of work is the facility with which the foundations for the wall columns have been adapted to form watertight, subterranean enclosures reaching to rock and protecting the entire interior space from quicksand, water and pressure, so that the excavation may be made and foundations built there in great safety and economy. Such work is, of course,

adaptable to many other kinds of construction and its advanced practice is exemplified by the job described on page 83, which was executed by contractors with a long record of work executed with uniform success, often under great difficulties for various types of important construction in and around New York City.

The outstanding features of this work are the construction of the monolithic caissons, except for concreting the working chamber and shaft, before sinking was commenced; bonding adjacent caissons together with massive waterproof concrete joints that close the clearances between units and convert them into a continuous retaining wall or cofferdam; the application of similar joints to the connections between the new foundations and those of portions of the old building: the falsework supports for derricks enabling them to be operated without obstructing the very congested area of the lot; the very massive and thorough system of temporary cross lot bracing, designed to give ample protection against any possible hydrostatic pressure on the exteriors of the caissons; and the very excellent condition in which were found a number of concrete piers sunk on the site of the new building by the pneumatic caisson process about 20 years ago and still in perfectly satisfactory and reliable condition.

It is also of interest to note that this work was under construction in a more or less critical stage well within the radius of the frightful Wall street explosion last year and did not suffer any material damage therefrom. The safe and satisfactory execution of this difficult work in treacherous soil adjacent to some of the most thronged thoroughfares in the world, in the heart of the New York financial district, without accident or inconvenience to citizens, obstruction to business, or injury to the costly buildings and treasure houses surrounding it, reflects credit on and inspires confidence in the engineers and contractors who accomplished it as a part of their every-day work.

Free Highway Construction from Politics

Promote in the minds of the American people the idea that they must divorce this one thing from politics, religion and favor. Make them understand, if you can, that while America is rich, rich beyond the dreams of avarice, it is not rich enough—now that hundreds of millions of dollars are to be spent in highways—it is not rich enough to play the highway game as it has played it the last ten years. America must wake up, turn over and start again with the one idea that this is the greatest business enterprise that the American people have ever undertaken and that it must be made a clean-cut and efficient operation.

The fact must be pressed in upon the American people that if they are going to get anywhere near the shadow of a dollar for every dollar they are so willing to spend in highway work, they must divorce that work from the average run of state and county business and put it on an absolutely sane and efficient basis. The men who work in the state highway departments are neither politicians nor grafters. Nine out of ten of them are graduates of high-class colleges and universities—most of them civil engineers. A right highway department, be it state or county, has a personnel of clean-cut, well-educated Americans who are neither crooked nor inefficient and who do not intend to become so; and if you are going to get and retain that kind of men in highway work, you must establish conditions in the business that are just as clean-cut and just as attractive as they are in any other kind of business. Those conditions are almost nowhere prevalent in the American states. You insist in all your promotion work upon efficiency in highway construction. Did you ever think that in the executive offices of the average American state there was no salary ever heard of above $5,000 a year? Most of the governors of the states get that or less. Three out of four of the executive officials of the state highway departments of America get $5,000 or less per vear. Is it any wonder that they are not world beaters or record breakers? It is not. The only wonder would be that so many good men are still in the business.—From an address before the Portland Cement Association by A. R. Hirst, state highway engineer of Wisconsin.

Research Studies on Paving Brick

In various branches of engineering work there has become increasingly apparent during the past few years a desire for research into various technical matters by governmental agents, engineering schools of high standing, national societies or other bodies which can secure necessary funds and whose conclusions will be received with confidence in their reliability. Undoubtedly this desire has been increased by certain of our experiences during the war.

Among the researches that have already begun to take form is one which is now under way in connection with burned clay products. This investigation is being made through the co-operation of the federal government, including the Bureau of Standards and the Bureau of Mines, the University of Illinois and others, the American Ceramic Society and the four national associations of brick manufacturers. Representatives of these various bureaus and organizations organized on June 16 a Joint Research Committee. The various associations have agreed to appropriate a considerable sum for the purpose of this research and the Bureau of Mines and Bureau of Standards will contribute two or three times as much.

The work of the research committee will be divided into two parts, the first dealing with the study and investigation of commercial kilns, and the second with the study of the water smoking and dehydration process by the Bureau of Standards, a study of heat absorption through all the burning stages by the University of Illinois, a study of oxidation and vitrification by the Bureau of Mines, and experiments in the study of combustion and the transmission of heat in a semi-commercial kiln by the Bureau of Mines at Columbia. The Bureau of Mines will make field studies of brick burning at various plants, many

of the brick companies having offered the use of their plants for this purpose.

The chairman of the committee is F. W. Butterworth, of the Western Brick Company, and the secretary-treasurer is M. B. Greenough, of the National Paving Brick Manufacturers' Association. The technical committee consists of A. V. Bleininger, chairman, of the Homer Laughlin Pottery Company; P. H. Bates, of the United States Bureau of Standards; R. C. Purdy, of the American Ceramic Society; R. T. Stull, of the United States Bureau of Mines and E. W. Washburn, of the Ceramic School of the University of Illinois.

It is encouraging to other industries and to engineers to note the active interest being taken in such practical research work by federal bureaus, bringing to the work federal funds (although these are limited in amount); and it is to be hoped that other research work along engineering and technical lines will be conducted with or without the material aid of the various bureaus of the federal government.

Construction Legislation in New York

Bills affecting contracts, labor, transportation, compensation, accidents and insurance, that were passed or defeated in 1921 and were respectively supported or opposed by the New York General Contractors' Association.

In the June bulletin of the Associated General Contractors of America there was published a review by C. A. Crane of 24 important bills out of 46 before the New York State Legislature that had been under consideration by the association's Committee on Law and Legislation, and pointed out that of these five bills approved by the association were passed and became laws, while 18 that were opposed by the association all failed to pass. Two more bills, favored by the association, were passed and signed by the governor and 19 bills examined by the association received no action from it.

BILLS FAVORED

The laws enacted that met the approval of the association were an amendment providing that retained percentages of contracts heretofore made might be withdrawn by substituting corporate stock or securities of a market value equal to the sum withdrawn; an amendment to the labor law, exempting construction on or for water works outside the limits of cities and villages from the provisions of the 8-hour law; an amendment to the rapid transit act relative to the manner to which action for the recovery of money on subway contracts shall be brought; an amendment to the Walter law of 1918, which was the state-wide relief law for contractors who in May, 1918, held uncompleted contracts which had been taken prior to April, 1917, when the United States entered the war.

Other bills approved by the association included the recodification of the labor law; an amendment to the workmen's compensation law providing that workmen's compensation shall be paid periodically in the place of wages as it accrues; and an amendment to the greater New York charter provided that the award of a contract may be made in cases where the low bid exceeds the appropriation, if an additional appropriation is secured before an award is made.

BILLS OPPOSED

The bills opposed and not passed were an amendment to the civil engineers' license law, which would have prohibited engineering or construction corporations from designing or supervising construction work as corporations; an amendment to the New York charter increasing wharfage and dock rates on lighters and North River barges carrying building materials; an amendment to the greater New York charter providing for the registration of architects, builders and others supervising building construction; an amendment to the greater New York charter permitting Borough Presidents to establish rates per square yard for street restoration; an amendment to the labor law prohibiting wives and children of employees on lighters to live thereon; an amendment to the labor law forbidding the use of any automatic hammers whose piston stroke exceeds 3 inches in length, and 1 1/16 inches in diameter, in the operation of which it is necessary to resist the recoil and vibration of the stroke by the pressure of the hands, arms or body and unless there is another competent man to assist in operation of said hammer; an amendment to the penal law prohibiting advertisements for employees during strikes or lockouts unless it is plainly stated in the advertisement that such a strike or lockout exists; an amendment to the penal law prohibiting all policemen, officers or guards taking part in strikes or other industrial disputes; an amendment to the penal law prohibiting the employment of persons to take the place of striking employees when such persons have not been bona-fide residents of the place in which the business of the employer is located for 30 days prior to such employment; an amendment to the insurance law requiring every owner of a motor vehicle to file with the Secretary of State indemnity bonds for not less than $10,000, said bonds to be given for the protection of property or persons injured by the owner of the vehicle; an amendment to the workmen's compensation law permitting injured employees to select their own doctor at the expense of the employer; an amendment to the workmen's compensation law providing that compensation should begin on the day of the injury instead of two weeks after; an amendment to the workmen's compensation law, extending the benefits of the law to employments in which two or more persons are employed instead of four or more as at present; an amendment to the workmen's compensation law increasing the period during which the compensation shall be paid for permanent partial disability; an amendment to the workmen's compensation law compelling the employers to insure exclusively in the state insur-

ance funds; an amendment to the workmen's compensation law providing for the insurance of the employees of a sub-contractor and making either the owner or principal contractor responsible for such insurance; an amendment to the workmen's compensation law including in the definition of the word "employee" a person who during the hours of his employment is engaged in traveling to or from the place of employment; an amendment to the highway law increasing the license fees for motor vehicles and automobile trucks and practically doubling truck licenses; a bill providing for a bond on public work contracts in addition to the bonds given for the faithful performance, such additional bonds being required for the payment of all labor and material furnished on the contract.

Stream Pollution by Industrial Wastes

Advancement in practice of treating wastes and recovering valuable materials therefrom. Ideas of health boards more rational.

At a recent meeting of the mechanical and engineering section of the Franklin Institute a paper was read by C. A. Emerson, Jr., chief engineer of the Pennsylvania Department of Health, in which he reviewed present conditions as to the pollution of streams by industrial wastes and the possibility of preventing such pollution, with special reference to Pennsylvania conditions.

He believed that "the cost of treatment of industrial wastes to prevent stream pollution should undoubtedly be borne by the industries responsible for the discharge. The enactment of rigid control legislation is only a portion of the remedy and might easily place such a burden upon the industries as to seriously disturb the prosperity of the state. Economical and effective methods of treatment must be developed and proven by actual plant operation before we are ready for stringent legislation."

The ideas of health boards are to-day more rational than they were a few years ago, when practically complete purification of trade waste was demanded, and they now "take into consideration the great variation in the physical and chemical composition of the different wastes requiring special treatment processes; the relative values of the industries to the state; the present uses and probable future development of the water course, and the ability of the stream to absorb and purify the waste by natural agencies."

Another forward step has been the realization that many industrial wastes contain matters of value which can be utilized and that many of the objectionable characteristics of wastes can be eliminated by improved methods of manufacturing.

The writer then described at some length the characteristics of wastes from tanneries, wool scouring plants, coke ovens, oil refineries, etc. In the case of tannery wastes the spent liquors can be concentrated by evaporation and used again, hair can be recovered, waste from the lime vats is removed by sedimentation, scrapings from the hides are sold to glue manufacturers, etc. Grease is recovered from the liquid wastes from wool scouring plants by centrifugal separators, one Philadelphia establishment recovering from 180 to 200 pounds of grease per day, which is sold to the refiners at a considerable profit over the cost of operating the separators.

Wastes from tar separators, by-product coke ovens, gas works and similar establishments are of particular importance because of the disagreeable tastes which their wastes impart to water, especially when it is chlorinated. In such cases the waste is excluded entirely from streams used as sources of public water supplies. At coke ovens all objectionable liquid wastes are used for quenching or cooling the glowing coke drawn from the ovens and passes into the air as steam. Water which is not evaporated is re-collected and used again. One coke oven installation in Pennsylvania thus turns into steam more than one million gallons of contaminated water daily.

Salt water from oil wells which in the past has polluted so many Pennsylvania streams is now discharged back into the well outside the pump casing instead of into the streams and serves as a medium for bringing more oil to the surface.

The most serious stream pollution in Pennsylvania is that by the discharge of coal mine drainage, which carries enormous quantities of acids and powdered coal into the streams. It is estimated that over 850,000,000 gallons of water are pumped from mines in the anthracite fields each day and nearly as much from the bituminous fields. It is estimated that these waters and the discharge from the washeries carry more than 3,000 tons of free acid and acid salts each day. How much coal is carried into the streams cannot even be estimated, but it is sufficient to obstruct the normal flow channels of the rivers, cause blockage of sewer outlets and increase flood damage during high-water periods over a considerable part of the state. The increasing hardness of the stream water adds materially to the difficulty and expense of maintaining at least 96 public water works in the state, supplying nearly 45 per cent of its total population. Altogether it is estimated that the cost of such pollution to the state is more than $8,000,000 annually.

Much of the coal washed into the streams is being reclaimed by means of small suction dredges which discharge the mixed sand, mud and coal over a screen having 6 or 8 meshes to the inch, which separates the sand and mud and the finer particles of coal from the larger size coal, which is marketable. It is estimated that about 2,000,000 tons of coal were thus reclaimed in 1920. Within the past two years several plants have been installed at mines for recovering the fine coal by sedimentation and neutralizing the acid water by lime treatment, thus rendering the mine water suitable for use in the breakers.

"Within the past few years various govern-

ment departments and bureaus and the scientific staffs of large industrial establishments throughout the world have undertaken comprehensive studies of methods of disposal of many industrial wastes." The object of these studies has been two-fold—to recover products of value from the wastes, and, where this is not possible, to develop some economical process for modifying the waste so as not to prevent any legitimate uses of the receiving body of water."

From the progress already made "it appears that the creation of nuisance in streams and the destruction of their usefulness through lack of proper disposal of industrial wastes has passed the peak, and that in a few years such improvements in the general condition of the surface waters of our industrial states will be obtained that they can be economically used for all legitimate purposes."

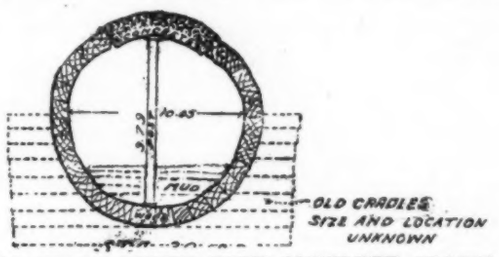
Muddy River Sewer

Replacing wood stave sewer in Boston by concrete sewer built in open trench, served by cableway and traveling gravity concrete mixer.

The old sewer in Brookline avenue, between Beacon street and Audubon road, Roxbury, Boston, consisted of an ancient cylindrical sewer, 10.05 feet in diameter inside, that was originally made with 4 x 12 inch wooden staves, from 15 to 20 feet long, lying in timber cradles a considerable distance apart in the clear. The cradles consisted of a number of courses of horizontal timbers reaching up to the spring line and probably serving as temporary plates for the assembling of the inverts when the sewer was built. The sewer was partly filled with soft mud and sediment and had at some time been partly rebuilt by removing a number of the staves in the crown that had probably decayed, and replacing them with a concrete arch segment or key about 3 feet wide that in some places was supported by vertical shores at the center point. The condition of the old sewer was so bad that it was considered dangerous, the roof had fallen in in some places causing settlement in the street above, and it was determined to replace a portion of it with a reinforced concrete sewer.

The new sewer 2,300 feet long has a rectangular cross section with a flat roof slab 18 inches thick, and an invert 14 inches thick at the center with a horizontal lower surface and the upper surface curved to a radius of 15 feet. The official design indicated that 6 rows of foundation piles, 3 rows on each side of the center line, were to be used for its support if necessary.

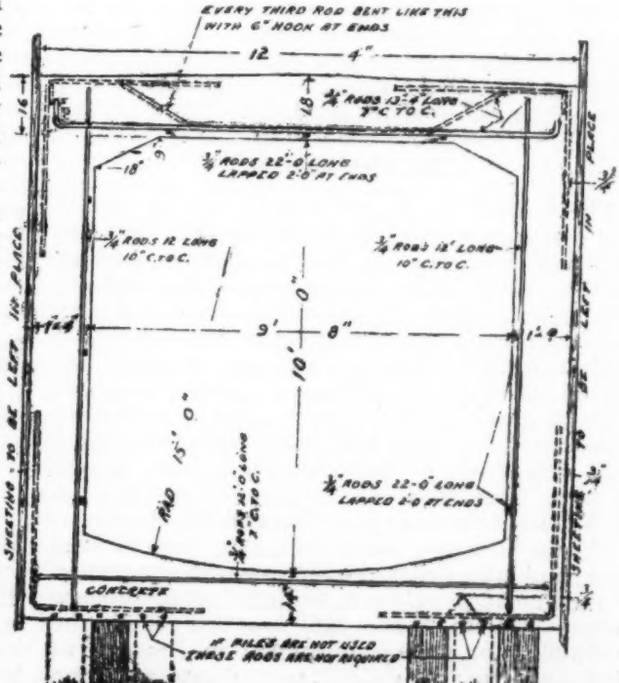
The new sewer received all of the flow of the old drains that carry surface water only, besides being provided at intervals of 20 feet with 6-inch and 8-inch pipe connections on both sides. The alignment coincides substantially with that of the old wooden sewer, which, with some other substructures that existed under the street, are entirely removed for the construction of the new conduit. The alignment is at a tangent and very light grade and passes, near Newbury street, under a set of five tracks of the Boston & Albany Railroad, the top of the sewer coming close to the subgrade of the track depressed in the cut. The samples recovered by the test borings along the line of the conduit,



OLD STAVE SEWER WITH CONCRETE CROWN

and carried down several feet below subgrade, indicated that the soil consisted of ashes, mud, peat, sand and gravel down to a considerable distance below ground water line, which is below the bottom of the sewer trench; indications that were verified as the excavation progressed.

The contract was awarded to the C. & R. Construction Co., Boston, B. S. Kelley, superintendent, and work was commenced in July, 1920, and was about 70 per cent completed July 1, 1921. A 400-foot cableway, supported on wooden A frames, was installed over the center line of the conduit at one end, and is operated by a steam driven hoisting engine. One end of the cable is anchored to a deadman and the opposite end is anchored by a stone pile 4 feet high, built on a 15 x 18-foot platform, mounted on sills to facilitate the movement when the cable is shifted, an operation which occurs about once in two months and puts the cable out of service for three or four days.



NEW CONCRETE SEWER BUILT IN O PEN TRENCH

The excavation, being entirely above ground-water level and in fairly loose open soil, is handled wholly with pick and shovel and the soil is hoisted in 1-yard steel buckets, operated on the cable and generally moved to the rear and deposited in back-fill without rehandling. The concrete construction follows close to the excavation so that an average of only about 70 feet of trench is usually left open at one time.

The deepest cut is 35 feet and the sides of the trench are sheeted with the wooden staves recovered in excellent condition from the old sewer. They are driven by hand with heavy mauls as the excavation progresses, and where it is very deep they are placed in two or three successive tiers, and are braced by five sets of 6 x 6-inch transverse braces. Old 8 x 10-inch timbers from the contractor's stock are used for rangers. Where the trench is shallower, fewer tiers of braces are required. The surface water entering the trench, and the flow of the old sewer are pumped out with a 6-inch centriugal pump operated by electricity and discharging directly through an adjacent sanitary sewer.

Concrete materials delivered by automobile trucks are stored on the macadam surface of the street alongside the sewer and are mixed in a Haines gravity machine, mounted on a 15 x 15-foot moveable platform spanning the open trench that travels along as the work progresses. The lower hopper of the mixer is suspended by chains from the platform and when the latter is moved can be swung aside to clear the bracing underneath.

The old macadam stone removed from the street in the top of the sewer trench, is removed by tilting buckets operated on the cableway that dump it on an elevated platform from which it is shoveled on both sides to inclined screens about 8 feet long. The dirt passes through the screens and moderately clean stone and gravel are deposited in piles on the ground and are then removed, for sale or for use on the work, by automobile trucks. The work is being executed by an average force of about 45 men working one 8-hour shift daily. The estimated cost of the job is about $250,000.

The Rat Menace

The menace of the rat as a carrier of disease was dwelt on with some emphasis by Edward A. Goldman, in charge of biological investigations for the United States Department of Agriculture, in a paper before the American Public Health Association. He stated that while the best-known rat-transmitted disease, bubonic plague, has caused the death of millions of people since the beginning of the Christian era and is ordinarily transmitted by fleas that have become infected from rats, these animals have also been known to have been involved in the transmission of trichinosis, infectious jaundice and rat-bite fever.

"Under ordinary conditions, rats tend to keep pace in numbers with the increase and congestion of the human population, an aggravating modern factor. Unless house rats are controlled, the probability of the establishment in America of plague centers very difficult to eradicate, and from which epizootic outbreaks would lead to wide spread human mortality, seems reasonably certain."

Rats multiply very rapidly. Ordinarily there will be from three to five litters a year averaging ten to a litter. On the assumption of only three litters a year with an average of eight to a litter and with no deaths, calculation would show a progeny in three years of nearly 4,000,000 individuals. The mortality rate obviously must be high or rats would soon literally overrun the earth.

The elimination or control of the rat pest involves both the destruction of rats and the elimination of places inviting their living and breeding. For destruction, the author recommends a type of snap trap that will be sprung by a rat in passing and catch the animal regardless of whether it is attracted by bait. Under proper supervision, poisons may be used to advantage, and it has been suggested that heavy gases, such perhaps, as some of those developed during the war, may be used for killing them in their holes. Rubbish piles, especially when they contain garbage or other matter that would serve as food for rats, form especially inviting habitations and are frequently occupied by thousands of these rodents. If all such rubbish piles could be eliminated a very high percentage of the rats in this country probably would be deprived of homes and the numbers would rapidly decrease. "No garbage or trash piles should be allowed to accumulate in the vicinity of stores, markets or human habitations, and loose material should be kept cleared away as far as possible. The rat-proofing of structures should precede or at least accompany all rat-killing campaigns.

"In one of our great army depots in France, millions of dollars' worth of supplies attractive to rats were stored in temporary structures, where, under stress of war conditions, rat proofing was out of the question; but from the beginning the policy was adopted of keeping the ground as clear as possible in and about the buildings and of turning over at intervals the great stacks of food supplies. This depot was located in the interior of the country with no heavily infested area near, but the district was well settled and rats in usual numbers were living about neighboring farms. A few, as might be expected, entered the depot of their own accord, and others were carried in with freight shipments from the base ports and in carts returning from the front. Although food supplies were easily accessible, the number of rats gaining a foothold in the depot was almost negligible. The importance of eliminating rat harborage was strikingly demonstrated."

Boston Municipal Fire Boats

The three new steel fireboats for the Public Works Department of the city of Boston are 57 feet wide, 174 feet long, and 9 feet deep, with a displacement of 650 tons. They cost $400,000 each and are equipped with a 2½-inch fire nozzle under 150 pounds pressure at each end of the boat. They are equipped for burning coal, but can easily be changed to burn oil fuel.

Construction Questions Answered

How to Handle and Erect Bridge Girders Without Special Equipment–II*

By cribbing, jacking, rolling and skidding.

In the absence of the ordinary steel erector's equipment, even of derricks, it is possible to unload and erect large girders with no other equipment than ordinary jackscrews, timber blocking, and skids or rollers

If the girders are for a crossing not previously spanned and are delivered at bridge grade, they may be erected by protrusion in a manner similar to that described on page 393, May 7, or on page 78, July 23, or by some modifications of this method, in which case the girders are generally erected in pairs, often fully braced together to form complete spans, before they are seated in their permanent position.

CONTINUOUS GIRDER PROTRUSION

If the bridge consists of more than one adjacent spans, all of them may be successively assembled at grade in the axis of the bridge on shore beyond one abutment, and the first two spans, properly connected together to resist cantilever erection stresses, may be rolled out longitudinally until the forward end of the first span rests on rollers on the first pier, after which another span can be added to the rear of the second span and the three connected spans, really thus forming a continuous girder structure, advanced until the first span rests on the second pier and so on, adding the successive spans at the rear until the first span reaches the last abutment and all spans are above their respective substructures and can be lowered to permanent position and the rollers removed.

If the height above the ground is small and especially if obstructions are permissible between the piers, a falsework of framed trestle bents, usually about 16 feet apart, or of cribbing, built up to the required height, can be constructed and longitudinal timbers placed on it forming stringers carrying a floor on which the spans or girders may be rolled to position, lowered to place, and the falsework successively removed from span to span in advance of the erection.

If the girders are delivered at low level they may be placed as close as possible to the ends of the piers and abutments, parallel with the bridge axis and gradually raised up to the required height by jacking under each end and cribbing, blocking and wedging to follow up closely. At the required elevation they may be lowered to bearing on rollers on transverse skids and pushed, perpendicularly to their axis, to the required position on the bridge seats of the substructure. If it is not convenient to raise them clear of the ends of the piers or abutments they may be skewed so as to clear the faces of the substructure, jacked and cribbed to the required elevation clear of the substructure, skewed back parallel with the bridge axis, moved transversely, and lowered to position as before.

UNLOADING BY CRIBBING AND SKIDDING

If the girders are delivered on cars they can be unloaded by jacking up each end sufficiently to release the blocks on which they are supported during transportation and substituting for them the ends of greased rails transverse to the girder to serve as skids to which the girders are lowered by a very slight operation of the jackscrews. The skids must project far enough beyond the side of the car to carry the girder to a position clear of the car and their overhanging ends must be thoroughly supported on cribbing or some other kind of falsework. After the car is unloaded it can be removed, and if the girder is supported on the cribbing the latter can be removed piece by piece, as the timbers are released and the girder lowered by jacking at both ends. If the girder is to be shifted a considerable distance transversely, it can be done by pushing it from the horizontal to inclined skids, well supported on heavy timbers and cribbing, and lowering it down the skids by gravity, great care being taken to safeguard it by means of snubbing ropes attached to each end, with one or more turns around suitable anchorages on the upper side of the girder. Several snubbing ropes must be provided in accordance with the weight of the girder, the steepness of the incline and the number of men to operate them. It is preferable to have the incline not steeper than 1 in 6 nor flatter than 1 in 12, so that the girder can be easily handled on it with pinch bars and the snubbing lines.

If the girders are very heavy and the number of jackscrews is limited or their capacity small, it is possible to handle it more slowly and laboriously, by providing two fulcrums, one near the center on each side, and rocking the girder alternately from one fulcrum to the other by means of the jackscrews at the opposite ends, assisted, if necessary, by a number of men walking to the opposite end of the girder and helping to balance it. By this means a very short lift blocked up with thin pieces of timber, bars or wedges, can be made with every oscillation, and the girder raised or lowered simply by shifting the fulcrum, which can even be done by shifting the counterweight without the use of jackscrews.

DELIVERY AT SITE AT GRADE

If the girders are to replace an old span already supported on the same substructure, it will often be possible to deliver them and unload them from

*Transportation to site and erecting by protrusion was published July 23.

the old bridge, move them out transversely to positions far enough away from the center line to permit traffic to be carried on between them and then to lower them clear of the old structure and replace the old floor with the new, piecemeal without much delay to the traffic. It will be quicker and safer, however, if the traffic can be diverted for a short time after the girders are in position, enabling the old superstructure to be entirely removed and the new to be built without regard to traffic.

If the old bridge is not strong enough to safely sustain the weight of the new girders while they are being carried across it, the latter may be supported on rollers at two points, one at the forward end and the other ¾ of the distance to the rear end. The latter roller will carry a much larger portion of the load, thus relieving the forward roller and the bridge floor under it until the girder is three-quarters of the way across the span, when the rear end may be jacked up on shore and the rear roller moved back to the end, thus increasing the load on the forward roller when it is near the farther abutment and will produce much less strain in the old trusses or girders than in the center. It is also possible, in many cases, to shore up the girders, floor beams or stringers of the old span temporarily while the new girders are moved across it and as soon as they are in the proper longitudinal position their ends can be supported from the substructure, releasing the old superstructure.

MAINTAINING TRAFFIC DURING ERECTION

If the traffic cannot be by-passed or detoured, and it is necessary to maintain it without interruption and if the new girders cannot be erected and the span assembled on the substructure while traffic is maintained on the old superstructure the required results may be accomplished by building falsework parallel and adjacent to the old superstructure on both the upstream and downstream sides. On one of these falseworks the new span may be assembled complete and finished ready for use in the proper elevation and longitudinal position and as close as possible to the old superstructure. Both old and new spans can be slightly raised and live rollers placed under them between upper and lower track rails, reaching from out to out of the two sets of falsework, and supported between them on the piers or abutments or on single bents of falsework adjacent to them. The traffic can then be stopped for an hour or two and both bridges moved transversely on the rollers until the new superstructure replaces the old and receives the traffic, being lowered to position and permanently seated as quickly as possible, while the old superstructure can be removed at leisure. Very short, light spans can be jacked transversely on greased skid rails without the use of rollers.

TRANSVERSE DISPLACEMENT OF MULTIPLE SPANS

An excellent illustration of the transverse displacement method above described is that which was adopted for the erection of the 12-span riveted truss bridge across the Wisconsin river at Merrimac, Wisconsin, which, although a railroad bridge, was handled exactly as a highway bridge might have been in a similar location.

Falsework was erected on both sides of the spans of the old structure and on one line of falsework three spans of the new superstructure were riveted up complete.

Hoisting engines and tackles were available by which the old spans were pulled out onto the opposite falsework in three minutes, the tackles shifted and the new spans pulled into the position formerly occupied by the old ones and lowered 15 feet in about five minutes each, the average time for replacing the span ready for traffic being about two hours.

After a set of three new spans was erected, long transverse beams overhanging both sides of the structure were mounted on cars, two bents of falsework hoisted from each end of the beams, balancing each other, and carried forward to the next old span in advance where they were seated and braced together to form a stable tower, and the remainder of the falsework shifted the same way, ready for the erection and transportation of the next span, and so on.

BINGHAMTON BRIDGE

The Court Street highway bridge at Binghamton, consisting of four half deck spans with three 85-foot Howe trusses each, was replaced by four plate girder spans of the same length, each consisting of five girders 7 feet deep. These were shipped singly, loaded flatways on two end cars with a spacer between.

They were jacked up on the cars and skidded off to rest on two ordinary heavy wagons from which the reaches had been removed and each replaced by three 8 x 8-inch timber 12 feet long, bolted to the axles of each wagon. Across the centers of these timbers were set 8 x 8-inch bolsters pivoted in the center to the middle timber to revolve on short bearing pieces of iron on tops of the timbers.

The girder was loaded so that the bolster of the forward wagon was 12 feet from the front end of the girder and that of the rear wagon 20 feet from the rear end, leaving a space of 52 feet between bolsters. The bolsters were about 9 feet long and had 1 1/3-inch iron pins driven through their ends to secure the girder from slipping sidewise.

Six horses were attached to the front wagon and two men walked underneath the girder steering the rear wagon by its tongue. The girders were carted half a mile to the bridge site and jacked off from the wagon to blocking from which they were gradually lowered to the ground to rest flatwise on eight 3-inch solid iron rollers 10 feet long running on 6 x 12-inch stringers.

They were rolled out to approximate position on the deck of the bridge on this track and were then revolved into a vertical position by a heavy tackle suspended from gallows frame set on the top chord of the old trusses. They were then removed on transverse greased rails, their transverse bracing assembled, and lowered to final position in the manner best suited to the removal of one half of the old structure, while the traffic was diverted to the other side of the bridge, which was later replaced in a similar manner, while traffic was maintained on the first longitudinal half of the new superstructure.

Recent Legal Decisions

CITY NOT BOUND TO PROTECT TROLLEY POLES RIGHTLY IN CENTER OF STREET BY GRASS PLOTS OR CURBING

In an action against a city and a street railway company for injuries to a passenger in an automobile resulting from contact with a center pole in a street supporting trolley wires, the New York Appellate Division holds, Wegmann v. City of New York, 186 N. Y. Supp. 893, that the company, being authorized by the state to operate on overhead trolley, could only be held liable if the pole was not placed with due regard for the public safety, and, the evidence showing that without the pole there would be the danger of breakage of the span wires, on a span of 120 feet, bearing four wires charged with a high-voltage electric current, which would then be thrown into the street, there was no proof that the choice of place by the company was unreasonable. The plaintiff claimed that there should have been grass plots or other curbed spaces around the pole. It was, however, held that there was no obligation of either the city or the company to make a more extensive appropriation of the space of the plaza where the pole was erected to the use of the trolley companies than was necessarily required for such use. The court said: "If a person would run into a trolley pole extending 22 feet in the air, with a 4-foot white band painted on it at the height of the eye, hence directly in the line of vision, would greater safety be assured by a grass plot or a 4 or 6-inch curb surrounding the pole?" Judgment for the plaintiff is reversed and the complaint dismissed.

IMPLIED POWER OF CITY TO SELL HEAT AS A BY-PRODUCT OF ITS LIGHTING PLANT

A city cannot operate a heating plant until it is legally established, but the use by a city of exhaust steam from its legally established lighting plant to heat city buildings and the sale of some of the heat service to private individuals is not within Iowa Code, par. 720, requiring authority from the electors to establish such a plant. N. E. Burkitt Motor Co. v. City of Stuart, Iowa Supreme Court, 181 N. W. 762. The subject matter of the contracts with the private consumers was the sale of a by-product that otherwise would be a waste. The city has the right to heat its own municipal buildings, and in so doing requires no franchise from the electorate. "The power of a city to dispose of its by-products resulting from the legal operation of its municipal agencies is necessarily implied and incidental to powers expressly granted. A city may sell and contract for the sale of the ashes resulting from the operation of its steam plant, or the dirt, coal, or rock taken from its streets in the improvement thereof, or manure from its barns, or the grease and refuse from its incinerating plant. True, the city may not engage in an independent business. In such case the doubt is resolved against the delegation of such power, and no power by implication arises unless it is indispensable to the powers expressly given. . . . The sale of a by-product by the city bears no relation to taxation except to lessen the burden thereof by securing revenue from sources that otherwise would constitute waste."

CONTRACT FOR DELIVERY BY INSTALLMENTS WITH POWER TO CITY TO REFUSE TO ACCEPT FURTHER DELIVERIES LACKS MUTUALITY

The Georgia Supreme Court holds, National Surety Co. v. City of Atlanta, 106 S. E. 179, that where, in response to an advertisement by a municipality for bids for the furnishing and delivery of coal for a period of twelve months, a bid is made to furnish a specified number of tons, and a contract is afterwards entered into for the delivery of so many tons per month at a given price and at a stated place, but it is expressly stipulated in the contract that the purchaser shall be at liberty at any time by a written notice to order a suspension of deliveries of the coal and to refuse to accept further deliveries, the element of mutuality is wanting in the contract. Orders subsequently given by the purchaser for deliveries of a portion of the quantity included in the bid will not render the contract binding upon the bidder, even for the delivery of the portion thus ordered. This is not an acceptance of the bid as made. There being no contract binding upon the principal, the bond for performance was not enforceable against the surety.

TOWN WITH PRESCRIPTIVE RIGHT TO DIVERT WATER MAY ENJOIN DIVERSION BY UPPER OWNER

The Supreme Court of Appeals of Virginia holds, Town of Gordonsville v. Zinn, 106 S. E. 508, that a town which owns only an acre of riparian land, but which, by its adverse collection, dominion and control of all the water of the stream which flowed down to its said lot for longer than the prescriptive period, has acquired by prescription a substantial right against all lower riparian landowners, and hence a vested right, to the exclusive use of the water to that extent, may enjoin an upper owner from withdrawing the water in such quantity at any time as will in any degree diminish the quantity of water which the proof may show that the town has by prescription acquired the right to divert for its daily supply.

INTEREST ON BOND OF CONTRACTOR FOR PUBLIC WORK NOT RECOVERABLE WHERE SUCH IS LAW OF STATE WHERE CONTRACT MADE

In an action by the United States on the bond of a contractor for public work, given under the federal statute, for the fulfilment of the contract, the federal district court for the district of Delaware holds that where by the law of the state where the contract and bond were made (in this case North Carolina) no recovery can be had in excess of the penalty in a penal bond, interest on such sum is not recoverable. United States v. Garland, 271 Fed. 14.

NEWS OF THE SOCIETIES

Aug. 10-12—INTERNATIONAL ASSOCIATION OF STREET CLEANING OFFICIALS. Annual conference. Hotel La Salle, Chicago, Ill.

Aug. 23-25—AMERICAN ASSOCIATION OF PARK SUPERINTENDENTS Annual meeting. Detroit, Mich. Secretary, Emmet P. Griffin, Superintendent of Park, East St. Louis, Ill.

Aug. 30-Sept. 1—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting. Flint, Mich.

Sept. 13-16—NEW ENGLAND WATER WORKS ASSOCIATION. 39th annual convention. Bridgeport, Conn. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

Oct. 5-7—SOCIETY OF INDUSTRIAL ENGINEERS. National convention. Springfield, Mass.

Oct. 1-15—LYONS FAIR FOR PROMOTION OF INTERNATIONAL TRADE. Lyons, France.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

NATIONAL ASSOCIATION OF STREET CLEANING OFFICIALS

The second annual conference of this association will be August 10, 11 and 12, at Chicago, during the "Pageant of Progress" to be held by Chicago during August. Headquarters will be at the Hotel La Salle. There will be a conference with a luncheon at the hotel on Wednesday noon and a beefsteak supper at another hotel on Wednesday evening. The annual banquet will be at the La Salle on Thursday evening. Conference sessions will be called for Wednesday afternoon and both morning and afternoon on Thursday. There will be no formal papers but round table discussions of questions will be brought up by those present.

THE NATIONAL ASSOCIATION OF BUILDERS' EXCHANGES

According to a statement of I. E Sprankle, state commission for the National Association of Builders' Exchanges in Ohio, every city and town in America of 10,000 population should have an exchange with which smaller rural communities should be affiliated. The state should have a separate state organization that should be a member of a national organization, the rules and regulations of the different exchanges and their combinations should be standardized.

The exchanges should function in legislative matters, including taxation and all matters of city or national nature. Among the important subjects that require their attention is the tax imposed in many states upon real estate investments, banking laws discriminating against building business and other laws and rulings by which money is driven from real estate investments to other channels.

THE MINNESOTA STATE BOARD OF REGISTRATION

The State Board of Registration for Architects, Engineers and Surveyors, just appointed by Governor J. A. O. Preus, of Minnesota, is composed of F. W. German, architect, Duluth; H. T Downs, architect, Minneapolis; A. F. Gauger, architect, St. Paul; F. W. McKellup, civil engineer, Faribault; D. E. Woodbridge, mechanical and mining engineer, Duluth; Paul Doty, mechanical engineer, St. Paul; and N. Y. Taylor, land surveyor, Litchfield.

All architects and engineers in the state must have six years of acceptable study or experience and take out a $25 license and $10 yearly renewals.

TRADE PUBLICATIONS

SULTAN CONTRACTORS' EQUIPMENT

"Modern Road Building and Maintenance," just published by the Hercules Powder Co., has been prepared for the use of engineers, contractors, road officials, students and all who are interested in the rational and economic solution of the many problems connected with our public roads and traffic they are required to carry. The book was written by Andrew P. Anderson, highway engineer of the Bureau of Public Roads. It contains chapters on Planning the Road, Road Materials, Road Construction, Road Maintenance and Repair and Use of Explosives. A copy will be sent free to anyone making a written request to the Hercules Powder Company, Wilmington, Del., or to any of the branch offices of this company.

TEXACO ASPHALTIC CONCRETE

A Texaco asphaltic concrete wearing surface is made up of stone, sand, mineral filler and Texaco asphaltic cement. The steps in constructing a Texaco asphaltic concrete wearing surface are as follows:

1. Measure the stone and sand in the proper proportions and then mix them. After this heat the stone and sand to a temperature of from 325 to 350 degrees F. This is done in a heater or dryer.

2. At the same time, heat the asphaltic cement to the same temperature in a heating kettle.

3. When the stone and sand are brought to the proper temperature dump them into the mixer. Then add the proper proportion of mineral filler, which may be either Portland cement or limestone dust. After this is done, dump the proper proportion of asphaltic cement into the mixer, which has already made a uniform combination of the sand, the stone and the mineral filler. Then continue mixing until the particles of mineral aggregate are thoroughly coated with asphaltic cement and a homogeneous mixture is produced.

4. Dump it into a wagon or truck and convey it to the street or roadway to be paved. By the use of canvas covers or tarpaulins, the material may be hauled a long distance with little loss in temperature.

5. Dump it on the foundation and shovel it into place. Comb the material thoroughly with hot rakes as it is being deposited and smooth it to an even contour. Spread enough material to give the desired thickness.

6. Tamp the hot material along the curb or gutter and around all manholes, covers, valve boxes, etc., with hot iron tampers.

7. When tamping has been completed roll the newly laid pavement with a heavy self-propelled roller, first longitudinally and then diagonally.

8. After maximum compression has been attained by rolling, cover the surface of the pavement lightly with cement or limestone dust. The pavement is then ready for traffic.

(Excerpt from booklet sent free on application to Texas Co. Asphalt Sales Department, 17 Battery place, New York City.)

PERSONALS

Smith, Herschel C., formerly deputy state highway engineer of Oklahoma, has been appointed assistant professor of highway engineering and highway transport at the University of Michigan.

Welborn, M. C., division engineer with the Texas State Highway Department, has resigned to become city engineer of Paris, Texas.

Turner, Arthur J., for the past two years chief engineer for the Columbia Basin survey commission of the state of Washington, resigned that office on June 1 to become superintendent of construction on the Skagit River power project being carried out by the city of Seattle.

Leonard, O., has resigned as county engineer of Parker county, Texas, to accept a similar position with Travis county.

Middleton, Ellis G., has resigned as village engineer of Le Roy, N. Y., to accept a position with the highway commission of West Virginia.

McGrath, J. K., for the past five years county engineer of Fayette county, W. Va., has resigned to accept a position as division engineer with the state road commission, to have charge of the state roads in Kanawha, Clay, Fayette, Boone, Nicholas, Raleigh, Summers, Monroe, Greenbrier and Pocahontas counties.

Hagis, A. B., has been appointed city engineer of Jellico, Tenn.

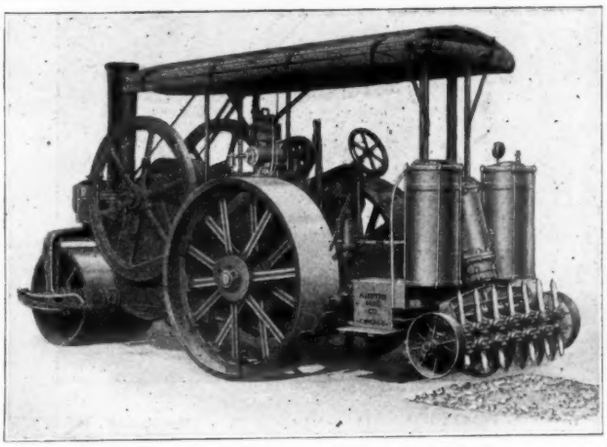
Harrington, W. H., has been appointed city engineer of Tracy, Cal.

Dryden, F. H., has been appointed city engineer of Salisbury, Md.

Wamsley, Judson, has resigned as county superintendent of roads of Montgomery county, Pennsylvania, and William Redington appointed superintendent of highways for the same county.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



MOTOR ROLLER WITH SCARIFIER

MOTOR AND STEAM ROLLERS

The handsome new Catalog F issued by the Austin Manufacturing Co., illustrates several types of improved road rollers with special reference to the latest advance in the development of a type operated by gasoline motors. They are made in 7, 8, 10, 12 and 15-ton sizes equipped with 4-cycle horizontal engines. Single cylinder engines are standard for the three-wheel rollers and double cylinder engines for the tandem rollers.

The three-wheel macadam type has ample power, can be started with a few minutes' preparation and runs many hours without requiring to stop. It can be operated either with kerosene, gasoline or lamp oil, carries a large supply of fuel, and requires only a small amount of water. It has a variable speed regulator and two positive gear changes, giving it very elastic speed for road travel. It has a reliable hand steering device, which, on very heavy rollers, can be replaced by power steering mechanism.

The Austin steam roller is especially recommended on account of the proper width of tread and distribution of weight and because it has 20 per cent more boiler heating surface than other standard steam rollers, thus making it especially efficient for rolling subgrade and macadamizing on hills and for scarifying and other heavy demands.

It can be provided with a scarifier attahcment having seven teeth that will tear up a strip of road about 5 feet wide at a trip. These are mounted on a frame that is raised or held down in position by air pressure.

The tandem motor roller is superior to the three-wheel roller because it is steadier running, has lower central gravity, higher road clearance, easier control, quicked and more elastic power steering and less operating costs. It is made in 5, 6, 7 and 8-ton sizes.

The same company makes an independent steerable scarifier weighing 6,400 pounds that can be hauled by a road roller and instantly detached.

The other road machinery manufactured by the Austin Co. and sold by the Austin Western Road Machinery Co., includes graders, dump wagons, stone spreading wagons, elevating graders, street sprinkler, several types of street sweepers, a two-speed sprinkler-sweeper, a pressure road oiler, a gyratory crusher and mammoth graders and road rippers.

DIPPER DREDGES

Dipper dredges, manufactured by the Bucyrus Co., have been on the market since 1883 and are said to outnumber all of the other high-powered dipper dredges in the world. They are used to advantage for widening, deepening and maintaining harbors, rivers, canals or ditches and for general submerged excavation on construction work and will dig harder and bulkier material than any other dredge. The bail of the large size dredges has a maximum pull of 250,000 pounds, which can be concentrated on a single tooth and enables it to dislodge and handle very large stones, trees and other obstructions.

The use of the dipper dredge is recommended for scow loading of excavated material, depositing spoil on adjacent banks, heavy digging, handling large or medium sized stones, handling material that requires blasting and dling material that contains sunken timbers or fallen trees.

Each dredge is designed to meet the requirements of the work under contemplation, and may be built in accordance with the specific information furnished in reply to a printed list of questions issued by the manufacturer.

The main engines may be twin tandem compound or double cylinder type and are usually made reversible with Stevenson link motion. The large engines are made non-reversible and the small engine is gear connected to the crank shaft to reverse the drum. On most of the smaller dredges the backing and stern drums are driven from the main engine. on the larger engines the hoisting shaft carries a friction clutch designed for operation from the same thrust cylinder.

The backing machinery for the larger dredges consists of an annealed steel casting drum, which is gear driven from a double cylinder engine. The swinging machinery consists of a machine grooved drum keyed to its shaft from a double cylinder reversible engine. Two sets of machinery are provided for hoisting the spuds. The stern spud machinery for the larger dredges consists of an independent unit with rack and pinion gear driven from a double cylinder reversible engine.

The structural steel boom is of the double-bow lattice of plate girder type with annealed steel foot castings. The shipper shaft is mounted in cast steel bearings at the center of the boom and is fitted with two pinions and two brake wheels. The dipper handle is composed of two timber members heavily armored on all sides with steel plates.

The heavy reinforced dipper may be of plate or cast steel and has a pin connected forged bail and a heavy plate door with latch keepers and forged steel hinges. It is provided with four forged steel teeth or a forged steel cutting lip. The swinging circle is mounted on an annealed steel casting that is rotated on the pintle of a heavy base plate. The A-frame legs are pin connected and guyed with wire rope. The dredges are designed to be operated either by steam or electric power, and the levers by which one man can control the principal operations are located in a position that affords the best view of the work.

The circular illustrates the three 15-

34 MEN STANDING ON PLATFORM SUSPENDED IN 15-YARD DIPPER BUCKET BUILT FOR BUCYRUS DREDGE ON PANAMA CANAL

yard dipper dredges purchased by the United States government for Panama Canal work, that are equipped with 6 x 28 x 24-inch engines and are designed to dig to a depth of 50 feet, and were operated at 45 seconds per cycle. One of them lifted a 50-ton boulder, which had to be blasted three times while resting on the dipper. Illustrations are also given of other dredges up to 15-yard capacities and hydraulic dredges with 12 to 28-inch suction pipes.

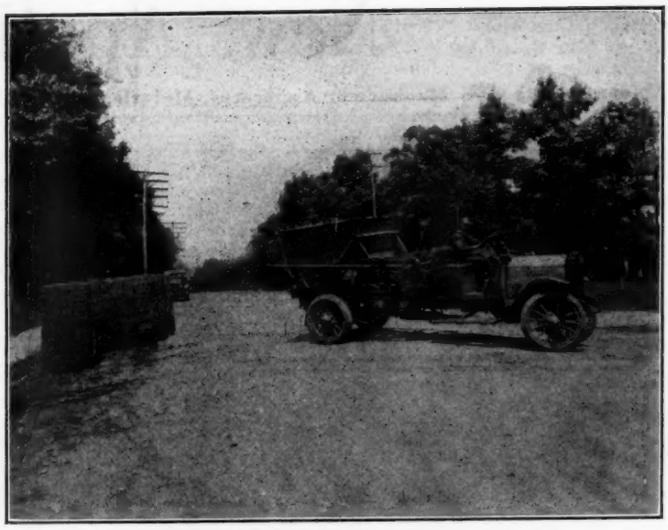
FONTAINE DEMOUNTABLE TRUCK BODIES

These bodies are manufactured by the American Truck Body Co., Inc., in three types especially designed for the rapid and safe unloading of 1,000, 1,500 and 2,000 brick stacks handled on pallets. They are made of 3/16-inch reinforced riveted steel plates and can easily be installed on any standard truck to which they are attached by U-bolts.

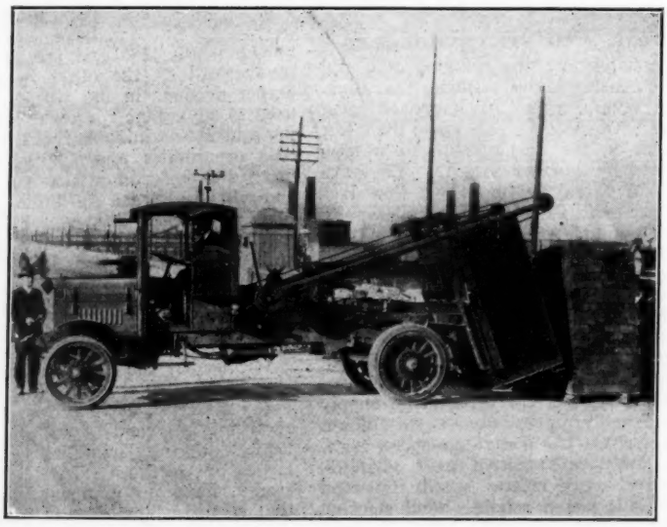
The equipment, which has several improvements over previous models, consists of a frame, with power hoist, cradle and two detachable bodies with pallets. The cradle moves back and forth on the frame in such a manner that the body may be set on the ground and then carried back on the truck in the proper position for hauling. The body is not lifted as a dead load, but is simply pulled over the arc of a circle, making it easier to handle the load. The hoist is sufficiently strong to handle the load with perfect ease, and is so made that it is self-locking so that the load may be held in any position desired. The power to operate the hoist is derived from the power take-off of the truck. If the "Fontaine outfit" is placed on an old truck, which does not have a power take-off, the power take-off can be obtained from the manufacturer.

The detachable bodies are held in place on the cradle by means of two lateral arms which securely hold a pipe on the body. It is impossible for the body to slip in any way whatever. When it is desired to detach the body, the equipment is lowered until the body is on the ground and then the arms pass under the pipe. The body cannot be detached while on top of the truck. The pallet acts as the tail gate of the body and is held in place by two iron pipes. When the load is deposited, these pipes are slipped out and the brick are left stacked on the pallet, when the truck is pulled away. The pallets are of rough wood construction and are left under the stack until the brick are used.

The Fontaine delivery system enables the truck body to be loaded at a convenient place. When loaded, the truck comes, picks up the loaded body, and carries it to its destination while the additional body is being loaded. The truck is continually on the go, and the time lost in loading and unloading is saved, the truck driver is the only man required to pick up the loaded body and deposit the load. When brick are dumped from a truck a large percentage are chipped and broken. But with the Fontaine equipment the brick cannot be broken. On a city street it is necessary that the brick be stacked, and this can be advantageously done first of all. As the body is packed to capacity, it is simple to check up on the number of brick delivered without counting them.



TRUCK BACKING INTO POSITION TO UNLOAD A STACK OF BRICKS



STACK OF BRICKS DEPOSITED ON GROUND, RELEASING TRUCK BODY THAT IS THEN RETURNED TO POSITION ON CHASSIS

TRUCK DRIVER UNLOADING STACK OF BRICKS QUICKLY BY POWER